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Unsworth, Ruth and Tummons, Jonathan (2021) Reassembling teachers' professional practice: an ethnography of intertextual hierarchies in primary mathematics. Ethnography and Education, 16 (1). pp. 109-126.

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Reassembling teachers' professional practice: an ethnography of intertextual hierarchies in primary mathematics

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Abstract

The formation of teachers' professional practice has been discussed in relation to a wide variety of influences, with government prescription of practice often criticised as oppressing professional agency. Set within an ethnographic study within one English primary school, this paper explores the role of intertextuality in the form of intertextual hierarchies during a policy-led period of change to teachers' professional practice: the introduction of a new way of teaching mathematics. Drawing on actor-network theory and literacy studies, we trace the stages of the translation of the new method from policy into practice, through the intertextual hierarchies which carry this knowledge across policy/practice boundaries. We highlight the crucial role of texts as actors within a remodelling of professional practice. Describing how the socio-material use and creation of texts leads to localisation of policies, we lend hope to schools in terms of their own agency within government-driven agendas. Data reported on draws primarily on fieldwork notes and document analysis, enhanced by semi-structured interviews with 3 of the 12 research participants.

Key words: actor-network theory; literacy studies; teacher professionalism; professional practice; intertextuality

Setting the scene

Teachers' professional practices have been recognised as drawing upon a wide, ever-evolving set of influences (Beauchamp & Thomas, 2009; Stronach et al., 2002), including practical, experiential knowledge, theoretical learning and politically-imposed policies. These influences have each been explored as problematic, with politically-determined practice drawing the greatest criticism.

Changing practice through the implementation of government policy has been seen as deprofessionalising in that government control of professional practice detracts from professional agency (Hargreaves & Goodson, 1996). In the field of mathematics teaching, challenges to government-led efforts to reform teachers' practice have been found in resistance to change rooted in teachers' pre-existing beliefs about pedagogy for mathematics (Stipek et al, 2001). And yet government initiatives, policies and politically-controlled curricula continue to abound within the profession.

In this paper we add to these international discourses by describing how teachers' practices for the teaching of mathematics were changed by a government-led initiative at one primary school in England. By detailing the localisation of policy through social interaction with – and creation of – a series of interlinked texts, we demonstrate how, whilst policy does indeed change practice, it is adapted into practice to work alongside pre-existing pedagogies and priorities. Through raised awareness of the process of changing practice by following national initiatives, we argue that schools may be able to take greater control of practice development, allowing for the incorporation of pre-existing pedagogical beliefs and counteracting notions of deprofessionalisation by policy-enactment.

One government-driven initiative which has gained much press internationally

over the past few years is the changing of professional practice for the teaching of primary mathematics into a pedagogical approach commonly referred to as 'the mastery approach' or 'Singapore Maths'. Essentially, the approach is a method rooted in problem-solving, reasoning and approaching problems in a variety of ways. As of 24th June 2019, the mastery-based *Maths No Problem!* website described the approach as follows:

> *When taught to master maths, children develop their mathematical fluency without resorting to rote learning and are able to solve non-routine maths problems without having to memorise procedures.*

This paper does not seek to critique the mastery approach. Rather, as part of a wider ethnographic study exploring political, social and cultural influences at work in forming teachers' professional practice, this paper describes the process of changing practice, in response to the mastery maths initiative. In particular, we describe the network of related texts which are both used and created by teachers, school leaders and policy makers during the change process.

Using actor-network theory (ANT) and Literacy Studies, we discuss how documents are used to enrol teachers' interests, to pass on new practice to be used collectively, to summarise collectively-agreed understandings of the new practice and to move knowledge of the initiative from policy into practice. We show how this process involves a continuous disassembling and reassembling of the original initiative and how this demonstrates that the mastery maths initiative has not been blindly followed or unproblematically reproduced, but appropriated into, and affected by, pre-existing social actors from within the school.

The setting: Highland School

Highland School teaches children between 3 and 11 years old, with 3 classes per year group. It is situated within a socio-economically diverse community within which it is highly regarded. Historically, the school has performed highly in nationally-reported tests at age 7 and 11, and has inspection reports of the highest grade. Following the introduction of a new mathematics curriculum and national assessment system in 2014, the school experienced a drop in the number of children achieving higher levels of attainment in mathematics. In 2015, a decision was made by the then school leaders to follow the government-promoted initiative of training teachers to teach mathematics using the mastery approach.

The school invested in training in Asia for two teachers, one of whom became the maths specialist for the group of schools (MAT) of which Highland School is part. Following this process, further in-school specialists were given training, in England, over the course of a year, run by a government-funded association for mathematics teaching (MP). Simultaneously, teachers enthusiastic to be involved in the project were enrolled into MP-funded *Teacher Research Groups* (TRGs). The TRGs gather together groups of schools at a local level, with teachers in each school acting as hosts to the other members. Members gather at each school in turn, watching a live maths mastery lesson in the host's classroom, and afterwards discuss the techniques used and the learning observed.

Two years after maths mastery was adopted, teachers in six out of eight year groups at Highland School had received between one and two years' initial in-school training in the approach. Training has taken the form of regular staff meetings which are run by Frances (TRG member) and Laurie (subject leader of mathematics), focusing on

a staged approach to introducing maths mastery pedagogies. Gap tasks and projects are set for year groups between meetings and they are asked to report back on these at subsequent meetings. A new lesson-planning format has been introduced and school mathematics policies have been redrafted. Laurie has worked with year group leaders to develop planning guides which bring together the mastery approach with existing resources. Year group leaders lead planning sessions with their teachers each week, using the new planning format, resources and guides which either Laurie has created, have been taken from the MP website, or have been adapted from TRG materials.

Fieldwork

The data and findings that we discuss here are derived from a larger ongoing ethnography at Highland School, conducted by the first author, investigating the professional knowledge, practices and values of teachers. Specifically, for this paper, data was constructed through participant observation by the first author (Denzin & Lincoln, 2018), immersed in the school during a four-month period during the 2017-2018 academic year, 'hanging out' with teachers during their daily working lives. The school is positioned as the natural setting at which the people and practices being studied – that is, the teachers and their developing professional practice in relation to mastery maths – were to be found (Crang & Cook, 2007; Geertz, 1998; Mills & Morton, 2013).

Year group teams (consisting of between three and four teachers) were observed throughout the school day. This involved being present for all of the activities the teachers were involved in each day: planning and preparation activities before school; teaching in class; playground duties; staffroom breaks; planning meetings and training events. Over time, the extent to which teachers also worked at home became apparent

and although these professional activities could not be observed (due to being beyond the ethical as well as pragmatic scope of the ethnography), these were discussed in both informal interludes and through more formal semi-structured interviews.

Ethnographic fieldnotes were constructed throughout the period of the study which were transcribed and analysed on an ongoing basis (Walford, 2009). Over time, as reactivity effects – whereby observer presence acts as a source of bias influencing the observed behaviour - diminished (Tummons & Duckworth, 2012, p. 77), teachers and children increasingly involved the first author in conversations and activities. For example, the first author was invited to help to sort resources with a teacher before a lesson whilst chatting about their work, or to join in briefly in a lesson activity being modelled.

The field notes constructed through observation were augmented through photographs (n=37), principally to record material elements of the practices being observed, documents (n=76) such as curriculum and planning papers, and semi-structured interviews (n=12) with teachers, school leaders, and other stakeholders, during which photographs and documents were variously used to elicit further insights (Fontana & Frey, 2000; Pink, 2007).

The findings reported in this paper are drawn predominantly from analysis of observations of staff developing their use of the mastery approach. We explore the documents used and created during the process of reframing teachers' professional practice, as part of training in and planning for the approach. Observations and document-based data are supported by extracts from interviews with staff who talk through the process of implementation. The research has been conducted according to the ethical guidelines of the British Educational Research Association. All data has been

rendered anonymous through the use of pseudonyms and the disguise of other signifiers such as places and specific dates of events (Christians, 2005).

Theoretical framework: Actor-Network Theory and Literacy Studies

Our standpoint is that the professional activities of the teachers at Highland School can only be made sense of if we acknowledge that equal importance needs to be given to the material *and* social influences involved: the influences of policy actors in the form of policy texts, as much as policy actors in the form of people cascading professional learning. These complementary ways of seeing the associations of human and material actors as performative of professional practice enable the exploration of agency in relation to material objects, particularly texts, as well as human agency. Here, we draw on Actor-Network Theory (ANT) in order to theorise these relations between humans and objects.

ANT has been described as a sociology of associations (Latour, 1987). Meaning and action are seen as the product of the organisation and associations of both human and non-human actors (Fenwick & Edwards, 2011). Drawing on *the principle of symmetry* (Latour, 2005), that is, of material and human actors in terms of their potential for agency in relation to each other, ANT allows us to view the full picture of the creation of collective knowledge or actions, through an investigation of the materials and the people at play without privileging one or the other. In ANT, such associations between actors lead to *assemblages* of meaning (Latour, 1987) which perform into being collective understandings, knowledge and practices. ANT offers analytical tools with which to describe these assemblages (we shall return to these shortly), and thus to describe society in its continual making and remaking. Although still a relatively underused approach, ANT has been used by ethnographers to highlight the formation of

professional practice through the interactions of the practitioner within the social and material contexts of teaching (Nespor, 1994; Plum, 2017; Tummons, 2010; Tummons et al., 2018).

More specifically, we draw upon the work of Callon (1986), and use his notion of *four moments of translation* to trace how the nationally-promoted initiative of teaching using the mastery approach is translated into the practice of teachers. We explore each moment of translation in terms of the key actors working together to exert influence. Translation offers a way of viewing how an imposed alteration to pre-existing practices is or is not achieved. In detailing each of the four moments of translation, Callon describes the interplay of existing and introduced actors, producing successful, or unsuccessful, use of a developed strategy through a process of interaction. First in the process is *problematisation*, in which the current issue is problematised as needing change. Second, *interessement* weakens links between previous actors, achieving buy-in from some key actors. Third, *enrolment*, whereby actors are enrolled into the ways of the new practice; and finally *mobilisation*: actors act – or do not act – within the new practice parameters, either stabilising or destroying the network holding the new practice together. Within each moment of translation, both human and non-human actors interact, creating either a socio-material achievement, or dissolution, of the intended development.

During fieldwork, it became apparent that a wealth of text-based actors – policy documents, curriculum documents, teaching resources, and so forth – were at play. From the perspective of ANT, this is unsurprising: any social project rests on heterogeneous networks of both human and non-human actors. From an ANT perspective, texts (irrespective of modality) can carry both meaning and intention and can extend agency in a way that bodies cannot, because they can travel across

institutional and geographical boundaries (Law, 1994). However, a rich or robust explication of how texts ought to be researched within an actor-network account remains elusive, reflecting the broader criticism of ANT literature as lacking methodological detail, notwithstanding the consensus that ANT demands a focus on the empirical (Elder-Vass, 2015), and an "insistence on painstaking ethnographic research" (Kipnis, 2015: 43). Simply put, ANT recognises the theoretical affordances of an analysis of texts, but not the concomitant methodological strictures. In order to supplement ANT, therefore, we drew on theories of literacy as social practice – Literacy Studies – in order to provide us with a conceptual framework that would be epistemologically aligned to ANT. Literacy Studies is a framework for exploring literacy practices in the widest sense that rests on a sociocultural theoretical framework and derives from social and anthropological studies of literacy (Heath, 1983; Gee, 1996; Street, 1984) and has been used by ethnographers to explore the work of texts in various educational contexts, including family literacy classes (Pahl, 2007), religious education classes in primary schools (Papen, 2018), and youth work (Thériault, 2015).

Literacy studies has provided us with several key concepts for the critical analysis of text-based artefacts (for what follows, see Barton, 1994), which are conceptualised as being employed within *literacy events*, which are any activities where literacy has a role. Such events arise from *literacy practices*, which are those general ways that people use written language in all sorts of social contexts, whether at work, at home or elsewhere. Literacy events are relatively straightforward to observe and to capture from an ethnographic perspective (Hamilton, 2000). Literacy practices are more complex, however, and this is because they also involve how people feel about, or the extent to which they value, the literacy in question. Thus, "literacy is best understood as a set of social practices; these can be *inferred from events which are*

mediated by written texts" (Barton, 1994: 8, emphasis added). Finally, literacy is not the same across contexts: there are different literacies, enfolded in different literacy practices, which are identifiable and which belong to different social contexts or *domains*. The ways in which different texts and practices can be combined and can influence each other can be constructed in terms of *intertextuality* (Barton, 1994).

Thus, texts can be seen as carrying and transforming meaning from an original idea to a final, distant practice. It is in describing the associations between people and texts (and other material actors) which perform the change to professional practice that a series of interlinked texts emerges. This series of interlinked texts forms an *intertextual hierarchy* (Smith, 2005), expanding Barton's idea of intertextuality to reveal the performance of policy into practice, through a series of interactions involving the reading and creation of texts. Through the intertextual hierarchy, recommendations for professional practice move from original global (political/commercial) domains to local (school/classroom) domains. As part of an intertextual hierarchy, texts are discussed in this paper simultaneously as possible actors upon human understanding, through interpretation, and as methods of capturing and carrying interpretations over a distance and wide-spread area otherwise unfeasible for a single human. It is to be noted that whilst the creation and use of the texts are discussed sequentially from problematisation through to mobilisation, as an intertextual hierarchy, data was secured by, as Latour would have it, starting in the middle (Latour, 2005), following the actors (the texts, the materials, the people) as they interacted, tracing their creation and usage backwards and forwards. They are presented here in sequence for the purpose of explicating the network creating the change in professional practice.

Findings: tracing the actor-network of mastery maths

Problematisation

In Highland School, the first step in changing teachers' professional practice for the teaching of mathematics involved identification of the reason for change, problematising current practice and making explicit the need for adaptation. In Highland School, problematisation of the mastery approach was linked to another government-driven change: a renewed national assessment system, which moved from numerical grades to statements of attainment:

> *In 2014, the English national curriculum for primary mathematics was renewed, with changes to expectations of content and skills for each year group. Subsequent revision of national assessments at end of key stages 1 and 2 reflected these new expectations for knowledge and skills, shaping these into descriptions of whether a pupil had 'met the expected standard' for the end of the key stage, or had attained the higher standard of 'working at greater depth'. In Highland School, this change brought a decline in children achieving higher levels of assessment for maths, whereas previous years had consistently high attainment in this area. In 2015, the school sent two teachers on a government-funded visit to Shanghai, to study the teaching methods involved in the mastery approach, which was advertised by the UK government as supporting learners to think in depth about maths. Meanwhile, the Department for Education funded a national project around the teaching of mathematics, whose remit was to roll out national training and advice on the mastery approach. Selected teachers from Highland School were invited by school leaders to attend several layers of this nationally funded training: specialist maths leader training, regional*

> *gatherings of and training of teachers, and Teacher Research Groups, which focused on developing elements of the mastery approach. (*Field note: May 2018*)*
>
> *'I'm not saying that everything is results-based, because it isn't, but our rationale for looking at maths mastery and greater depth has been looking at actually we need to increase the number of children who are coming through working at greater depth. We can see that there's disparity there and it gets greater over time.'* (Interview: Wallace, school leader. June 2018).

At this stage, government-driven initiative is promoted by an already-emerging barrage of (also government-driven) texts, acting in the background – publications of school data; published descriptions of what it means to achieve the standard of 'at greater depth'; the myriad of documents surrounding the renewed national assessment system. Drawing on concepts from ANT, we see that these government-driven documents are not treated as *matters of concern*, whereby their social creation remains in the foreground of discussions and thereby the contents of documents remain questionable, but as *matters of fact* (Latour & Woolgar, 1986). Working towards achieving what is set out in these documents – working towards the standard of 'depth' in mathematics - is seen as a 'need'.

There are consistently *matter of fact* references to 'depth' in planning documents, policy, teaching resources and discussions. The suite of government-issued assessment documents and texts related to the concept of 'depth' becomes an *obligatory passage point* (Law, 1994) – an accepted actor in the network with which all other actors associate, all decisions made through the lens of: does what we are doing achieve depth? This provides the *problematisation* on which the introduction of the mastery

approach can be hung:

> *'Teaching mastery is all about teaching thinking at depth.'* (Laurie, mathematics subject leader, recorded in field note: June 2018)

The mastery approach itself remains a *matter of concern*: a potential way of achieving the aim of the standard of 'depth'. For example, at a staff meeting focussing on exploring the maths mastery approach, the meeting begins with a reminder about what the school is aiming for in adopting the approach:

> *Frances clicks onto the next slide and a definition of depth is shared – a slide from the previous meeting.*
>
> > *"We tried to give you a mastery tool kit to achieve depth and we talked through open-ended tasks; opportunities for reasoning verbally and as they do this they learn. This has been happening throughout school and today we look at what we've all been doing."*
>
> *Laurie says,*
>
> > *"Don't be afraid to say what hasn't worked in the mastery approach – we're all on a journey together."* (Fieldnote - staff meeting: June 2018)

Striving for the standard of 'depth' is presented as the given aim, whilst the mastery approach is presented as a tool to achieve depth; a tool which is the subject of explorations within practice and reporting back on how things went, discussing where the approach didn't work: a tool to be questioned, adapted as the staff take the 'journey' of learning the pedagogy together.

That the *problematisation* of the need for the mastery approach is hung upon a government-driven concept has obvious connotations for teacher professionalism in general, highlighting the issues of governmental control of teacher practice and action already widely portrayed in the literature. However, it is in the treatment of the mastery approach as a *matter of concern* that hope for teacher agency around adaptation and usage of government-driven initiatives can be found.

Interessement

Perhaps because of its treatment as a *matter of concern*, the translation of the mastery approach from nationally-promoted initiative into teachers' practice can be seen as a process of negotiation involving an achievement of buy-in, appropriation into existing practices and decisions around usage/ exclusion and adaptation of elements of the approach. Within this process, we can see *interessement*: the weakening of links between existing actors (in this case in the current collective understanding of the practice needed to teach primary mathematics) and achieving buy-in from actors key to the change (Callon, 1984).

Interessement is achieved in this case through MP-run training opportunities which are structured for group discussion and interaction with the materials – texts and teaching resources – for teaching using the mastery approach. During these training sessions, pre-existing practice is actively questioned and compared to the new mastery approach.

> *Laurie has been one of the school's maths subject leaders for a year. He has attended subject leader training run by the government-funded MP - a 4 day course – and he invited me to go with him to the final day of training, held at a local secondary school… One trainer points out sections which are 'probably*

> *quite different to how we have taught or how we expected children to think.' Explanations are given as to why these different ways of teaching/ thinking about fractions are preferred to those of the past. 'I really have to train myself to do this,' the course trainer says as she models a concept again, writing on a whiteboard. She repeatedly phrases her explanations as: 'I used to…. And now I insist on…. That has made a difference to the children's understanding.' Delegates work through the new practice as set out in the slide decks, articles and textbooks provided on tables (all centred around the mastery approach), with current understandings and delegates'/trainers' own experiences juxtaposed explicitly with examples in the texts.* (Fieldnote: June 2018)

Here we can see the weakening of links between actors as the faults in a previous system are highlighted, whilst the new system is praised (Hamilton, 2011). In this case, this is achieved through the juxtaposition of practical experiences of the teachers and course trainers with examples of the promoted mastery pedagogy in texts such as training slides, articles and a mastery approach textbook.

> *As Laurie works to understand a concept, he makes notes on the slide deck handout and refers back to previous slides, to the provided textbook and an article recommended for pre-reading by the MP. He says to me, 'I need to get my head around this, change my own thinking.'* (Fieldnote: June 2018)

Laurie's change to thinking is mediated by the provided texts, guided by explanations verbally given by the course trainers. These texts fall into two categories – global (nationally used) published texts and localised interpretations of these in presenters' slides and the pre-reading provided. Here we can begin to see the kind of shaping of local meaning generation by 'global forces' (Pahl & Rowsell, 2006, p. 11) that

ethnographers of literacy as a social practice have highlighted. For example, Rowsell's study of publishing practices traced meanings throughout multiple texts, noting how meanings from corporate environments could be discerned within published texts which filtered into school literacy practices (Rowsell, 2000, discussed in Pahl & Rowsell, 2006). Similarly, Nichols, using an ANT approach, traced the idea of de Bono's 'Thinking Hats' from usage in boardrooms to classrooms (Nichols, 2006). As in Rowsell's and Nichols' studies, aspects of the maths mastery approach travel across global (political/ commercial) documents, through intermediary literacy events (such as this regional training session) and journey on to the local domain of the school site and the practices of the teacher: Laurie transforms his course notes into planned actions, Year Group Planning Guides and staff meeting slide decks, discussed later in this paper.

Crucially, I use the term 'aspects' to describe the mastery message which moves from global to local sites. Nichols and Rowsell have referred similarly to *traces* of initiatives found across sites. This is because it is only *parts* of the mastery approach which are focused on by course convenors in their training sessions, reduced further into school focuses by Laurie in his note-making, for instance in his completion of an audit tool:

[Figure 1 here]

Laurie selects the aspects of the mastery approach to develop back in school, just as other delegates do the same for their own schools, performing what Hamilton calls 'localising moves' (Hamilton, 2011, p. 67) on the mastery approach. These variations can be explored through Barton's notion of *intertextuality* (Barton, 2007) – meaning is carried across spaces, not via one document, but via a series of linked socio-material literacy events (discussing/reading/writing around an idea), from which emerges a chain

of interlinked documents. Aspects of previous documents are referenced explicitly and implicitly, whilst variations emerge according to the influences acting during each literacy event. We will now describe this intertextuality and how it results in the emergence of an intertextual hierarchy which forms the infrastructure of the approach.

Enrolment

We can see localisation of the initiative continued back in Highland School. In passing on the practice of teaching using the mastery approach, Laurie does not simply repeat verbatim the trainers' comments, nor does he give teachers every document he has been given, unchanged. Instead, he draws on discussions held with year group leaders and teachers to create a series of new documents to support teaching practice. Elements of the mastery approach are chosen to focus on, rather than the whole approach in one go. A chain of texts results, which forms a central part of the actor-network of the shared understanding of mastery in the school. It is to this textual infrastructure (Hamilton, 2011) that we now turn (see Figure 2).

[Figure 2 goes here]

> *Over morning break, Laurie talks me through the documents created during the process of the adoption of the mastery approach. The first level of these are school and MAT-based policy documents, which set out minimum expectations for pupil attainment and teaching methodology. These school and MAT-wide texts were created through discussions involving school and MAT leaders and trained in-MAT specialists.* (Fieldnote: 6th June 2018)

The contents of MAT and school-based documents blend pre-existing school aims and priorities with mastery and national curriculum/assessment framework information. Pre-

existing understandings of professional practice for the teaching of mathematics can be seen in the example of the 'Landmarks' document, which sets out the essential knowledge and skills pupils should achieve by the end of each school year. The 'Landmarks' document draws on a pre-mastery tool from the national curriculum for setting pupil attainment expectations by year group - key performance indicators (KPIs):

[Figure 3 goes here]

The Landmarks document is part of a suite of MAT-level documents created by school and subject leaders, which are used in unison to reflect on practice. Linked documents within the suite support teachers in designing teaching activities which will achieve these landmarks, and it is in these documents that mastery methodology is blended most evidently with pre-existing maths pedagogy. One such document is the Progression in Calculations document:

[Figure 4 goes here]

This document links the pre-existing national curriculum objectives to mastery approach methodology – concrete, pictorial and abstract presentations of the same learning being a key approach of the mastery method. Ideas for what these activities could look like are drawn from training materials, online banks of mastery resources and the current practices of teachers.

> *Laurie continues, detailing how the need for a new calculations policy was identified as the school began to adopt the mastery approach, to reflect the new methods being introduced for the teaching of maths, whilst taking into account the elements of existing maths teaching which were going well.* (Fieldnote: June

2018)

Localisation continues throughout the next tier of texts; those created by middle leaders in the school:

> *Laurie explains how he created the Year Group Planning Guidance documents in discussion with year group leaders. The documents rearranged the order of the national curriculum learning objectives to an order which year group leaders felt worked better for progression of learning, based on their experiences of teaching that age range. Resource banks were included which teachers already found valuable, as well as ones they had been introduced to from the MP training and discussions at TRGs. Expectations were aligned with those set out in the MAT documents, such as the Landmarks document.*
> (Fieldnote: June 2018)

[Figure 5 goes here]

Localisation has a transforming effect on global-domain initiatives (Hamilton, 2011). We can see this vulnerability and interpretability of wider initiatives in studies of attempts to determine professional practice through texts (Mulcahy, 2011; Tummons, 2016). This transformation is clearly seen in the case of the mastery approach, with the approach continually disassembled and reassembled into new material representations.

The influence of this text-based practice infrastructure relies on the co-existence of both texts *and* people to continue in its journey from policy to practice. It is the active use of these documents as reference points in discussing mathematics teaching which both moves the mastery approach into professional dialogue and action whilst simultaneously achieves a level of buy-in to the future use of the approach:

> *I went and taught in Year 2 using some of the activities from the Year Group Planning Guidance and they watched and evaluated using the Landmarks document. And then we saw it in a different lesson and then they've seen me teach my class because they wanted to see it in a class where it's been happening all year. Then they could see where the impact is. And because it was children that they knew, they were a little bit blown away by what the children were capable of… 'But so and so couldn't do this before' and I was like 'but they can do this now.' And that was a big buy-in. A massive buy-in.* (Interview: Laurie. June 2018)

Here, texts are *enrolled* as bases for comparison – they become representatives of what the children can do using this approach, in relation to teachers' knowledge of what children can do using existing pedagogies. These school-wide texts are bound to the teachers involved in their creation/usage. The ties between the people and texts are therefore irrevocable – the texts cannot exist or act without the teachers, and the teachers' meaning-making is mediated and confirmed through the interpretation of existing texts and the creation of new ones which set out their understandings of the approach they have gleaned from discussions of the former.

Mobilisation – variation, resistance and stabilisation within the network

Teachers actively use mastery approaches, as defined through the localising lens depicted above. Callon (1984) defines this final stage of the translation process as *mobilisation*, whereby actors act – or do not act – within the new practice parameters, either stabilising or destroying the network holding the new practice together.

In the case of Highland School, *mobilisation* is at first glance threatened by variance and resistance within the network. No ANT account should ever ignore the

anomalies present *within* a successfully (albeit temporarily) stabilised network. As Nespor reminds us, highlighting solely the mobilising associations of central actors and unified voices in a network neglects movements of actors at the margins (Nespor, 1994). Variations in teachers' usage of collaboratively-created lesson plans and slides exist in the ways in which they present these to the class:

> *After 5 minutes, Alex [Year 1 teacher] stops the children briefly and shows how learning now moves on to a specific learning objective: 'I can make doubles with numbers up to 20.' He talks through a worksheet available on children's tables, pointing at sections of the sheet shown on the IWB [interactive white board]. He gives a tip to the class, to notice that on a particular problem, they are likely to have missed something out… As the first child finishes their task, Alex directs them to the challenge on the IWB, to be done on the carpet on a whiteboard after tidying up their area. Alex explains the task to the class.* (Fieldnote: May 2018)

By contrast, other teachers use the same slides to raise questions, annotating the slides using an interactive whiteboard pen to capture the children's responses:

> *'Using your maths voice, who can explain this part?' Charlie [Year 1 teacher] asks, pointing to sections of the task on the slide. 'Talk to your partners first.' Charlie moves around the pairs of children, who are seated on the carpet in front of the interactive whiteboard on which the lesson slides are displayed. She asks pairs questions: 'Why is that true?', 'How else could you do it?'. She records some ideas, writing directly onto the slides using the interactive whiteboard pen.* (Fieldnote: May 2018)

These types of variation signal the continuation of the journey of intertextuality – individual teachers are creating their own understandings, practices with and representations of the mastery approach, continuing the localisation of the approach.

Traces of resistance as well as of variation can be seen across the network. Whilst most teachers follow the introduction of the approach without resistance, there is some open resistance to the approach. This centres around the view that the school generally has done very well in national testing in the past:

> *In a staff meeting sharing reflections on the mastery approach in practice, one teacher interjects when it is their table's turn:*
>
> > *'I'm going to be controversial. We generally get good results in tests as a school, so why should we change? I'm not saying that I don't believe that this is the way to go as I get what you're saying, but why should we change if we get good results anyway?'*
>
> *Frances [TRG member] thanks the person for their thoughts and says that it's important to have challenge to ideas. Laurie adds to this that what has driven them as leaders of this change, 'and what seems to be coming across in table discussions, is that…' he clicks on the slide deck and a quote appears from the creator of the nationally-promoted maths mastery texts and resources they are using in school. The quote centres around the idea that the approach encourages children to think deeply and reason with mathematics.* (Fieldnote: Staff Meeting. May 2018)

Resistance questions the very need for the change – the *problematisation* of current practice. The response to resistance is framed directly within the original tier of mastery

documents – a nationally-promoted textbook, which itself refers back to the importance of striving for depth of thinking: an indirect link to the national government-driven changes which drove *problematisation*. Here, leaders of the approach mimic the *problematisation* and *interessement* stages of the process, foregrounding an accepted-as-fact notion of striving for the concept of depth and connecting the mastery approach as a way to achieve this. Original-tier texts from the intertextual hierarchy are used to reinforce the network of professional practice-making, providing intertextuality with an additional role to that of the infrastructure of change: it also provides the mode of stabilising the change.

Indeed, despite the existence of variation and resistance within the network, maths mastery is an approach which is apparent in teachers' practices and their discussions with pupils and with colleagues. It is sometimes seen as consciously used, such as when discussed directly in staff meetings, but is often incidentally employed, such as in dialogue with students. So, what has helped to stabilise this network, as true at the time of fieldwork?

The answer to this appears to be in the elements of mastery which retain consistency of meaning throughout the intertextual hierarchy. Key phrases appear on staff meeting slides, in resources, in year group planning guides, in classroom displays, in reasoning resources, on lesson slides, in planning. These phrases signal parts of the mastery approach – for example:

> *On a maths display in a Year 1 classroom, key phrases are written, which are used in classroom dialogue in this and other classes:*
>
> - *Change one thing (pictures of a circle, a rectangle, a rectangle*

with rounded edges)

- *What's the same? What's different? (???)*
- *Do, then explain… (picture of cartoon face and speech bubble, alongside a pencil)*
- *Prove it! (tick symbol)*

(Fieldnote. May 2018)

These phrases are used in training resources, created into a reasoning mat for classroom usage, are added to planning guides, to lesson slide decks, and in professional dialogue about maths lessons. When asked about mastery teaching in mathematics, teachers refer to these key phrases, use them in planning conversations.

> *Meri, a Reception class teacher, asks for clarification on the maths lesson from her year group leader, Jamie. Jamie sits down with her at the PC, clicking through the slides. "Here, they have to prove it using a number line."*
> (Fieldnote. May 2018)

> *'Our complete shift in our approach has been driven by a change in vocabulary.'* (Interview: Frances. May 2018)

The occurrence of these phrases across the intertextual hierarchy and in professional dialogue signals what Barton highlights as the importance of language usage in constructing thought, language being a central actor in 'the mental models people construct of the world' (Barton, 2007, p. 73). Teachers' active usage of the key phrases and linked concepts embed the ideas into professional dialogue, signalling reframing of teachers' model of mathematics pedagogy and the successful *mobilisation* of the

approach. It is, however, important to remember that as actors within the network change – texts, school priorities and funding for the initiative itself – so may the network itself.

Conclusions: assembling the mastery maths network

Positing the texts involved in the changing of teachers' professional practice as both actors on and effects of socio-material literacy events has the benefit of bringing into view *how* practice is changed – the entanglement of human and non-human (specifically, textual) actors that has performed the change. Tracing these processes of change unearths a text-based infrastructure, whose nature reveals two key considerations for the wider exploration and understanding of teacher professional practice.

Firstly, tracing the intertextual hierarchy revealed intertextual links whereby content and concepts move across the boundaries of individual texts, across global sites (government department/ national publishing houses) to local sites (a school, a planning session, a classroom). In this way, we see how local literacy events and the meaning-making inherent within these are affected by actors from a more global network (Pahl and Rowsell, 2006; Nicholls, 2006). The global actors from political domains that have been explicated here are treated as *matters of fact* (Latour, 2005) and become *obligatory passage points* (OPPs) (Law, 1994) with which all other actors in the network must associate. Thus, government-issued texts become central nodes in the network – central actors driving the change. This aligns with those studies which have traced the continuance of governmental control of teacher professionalism (Clarke, 2002; Fenwick & Edwards, 2011; Mulcahy, 2011). The inquiry presented here adds detail to this view: detail around *how* this oppression plays out, for with an understanding of the process of

implementation of initiatives, schools may be able to harness opportunities for agency in the future.

Secondly, this study showed the crucial role of texts as actors within a remodelling of professional practice. The intertextual infrastructure of the change began to be self-sustaining: it became the backbone of the network, holding it together and supporting mobilisation of the mastery approach into planning, lessons, reflections, and is drawn upon to overcome resistance with the network (Latour, 1987, p 131). In changing the 'fact' of the professional practice needed for the teaching of mathematics, the intertextual hierarchy plays a key role. It convinces teachers through active usage of the texts in reflection on progress in learning. It controls through usage in decision-making in planning sessions and training sessions. It spreads the mastery approach throughout the school through lesson slides, resources, teacher-child dialogue, all of which contain traces of these texts. As a potential powerful infrastructure of change, one which both evolves the change and holds the network of change together, it is valuable, then, for schools to consider the intertextuality involved in the implementation of new initiatives: how might the initiative move from policy into practice and how can this be harnessed by schools?

Within this consideration, it is important to remember that the power of the intertextual hierarchy rests on the symmetry of agency of social and material actors (Latour, 2005): the texts are *used* and *created* and this is from whence their agency derives. Acknowledgment of this lends hope to schools in terms of their own agency within government-driven agendas. For whilst the concern around government dictation of teachers' professional practice is perpetuated by the findings of this study, depiction of the literacy events in the intertextual hierarchy highlights the *localising moves*

(Hamilton, 2011) made by teachers upon the mastery initiative. The original initiative and content of the mastery approach was itself changed by pre-existing professional practices and became localised, interpreted specifically for this school, stabilised through active choice of elements meaningful for the school. Localisation signals a certain level of potential for schools' agency to localise government-driven initiatives into professional practice which is appropriate for their own settings.

Nonetheless, a further series of questions emerge around teacher professionalism from this study. What would education and the teacher's role look like if the obligatory passage point was not government controlled, was not data-driven, but was instead derived from the practices of local actors? How would this change the network effects, and the understanding of professional practice created? The account provided here indicates the ways in which spaces for resistance, localisation, improvisation and recontextualisation all can be accommodated within an actor-network. An actor-network that nonetheless maintains form and, in this instance, constructs a new practice assemblage.

Declaration of interest statement

No potential conflict of interest was reported by the authors.

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